

Electron Configuration Practice Worksheet

In the space below, write the unabbreviated electron configurations of the following elements:

- 1) sodium $1s^2 2s^2 2p^6 3s^1$
- 2) iron $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
- 3) bromine $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
- 4) barium $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2$
- * 5) neptunium $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^6 7s^2 6d^1 5f^4$

In the space below, write the abbreviated electron configurations of the following elements:

- 1) cobalt $[Ar] 4s^2 3d^7$
- 2) silver $[Kr] 5s^2 4d^9$
- 3) tellurium $[Kr] 5s^2 4d^{10} 5p^4$
- 4) radium $[Rn] 7s^2$
- 5) lawrencium $[Rn] 7s^2 6d^1 5f^{14}$

Determine what elements are denoted by the following electron configurations:

- 1) $1s^2 2s^2 2p^6 3s^2 3p^4$ Sulfur S
- 2) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$ Rubidium Rb
- 3) $[Kr] 5s^2 4d^{10} 5p^3$ Antimony Sb
- 4) $[Xe] 6s^2 4f^{14} 5d^6$ Osmium Os
- 5) $[Rn] 7s^2 5f^{11}$ Einsteinium Es

Determine which of the following electron configurations are not valid, then write the corrected electron configuration using the SAME number of electrons:

- 1) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^5$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
- 2) $1s^2 2s^2 2p^6 3s^3 3d^5$ $1s^2 2s^2 2p^6 3s^2 3p^6$
- 3) $[Kr] 4s^2 3d^7$ $[Ar] 4s^2 3d^7$
- 4) $[Kr] 5s^2 4d^{12} 5p^2$ $[Kr] 5s^2 4d^{10} 5p^4$
- 5) $[Xe]$ $[Kr] 5s^2 4d^{10} 5p^6$

* don't worry about configurations for elements past 56 yet 😊

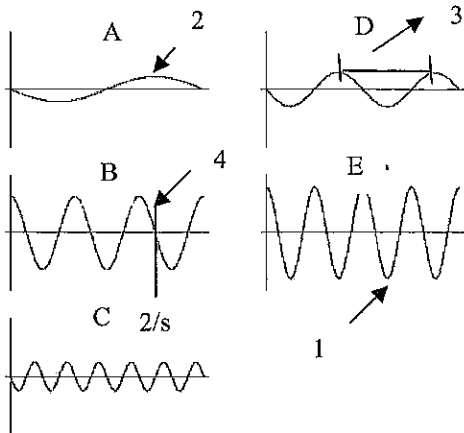
- A box (\square) is drawn for each one of the atoms ground-state orbitals
- An empty box represents an unoccupied orbital
- A box containing one arrow pointing up (\uparrow) represents an orbital containing one unpaired electron
- A box containing two arrows, one pointing up and one pointing down ($\uparrow\downarrow$), represents a filled orbital with 2 electrons
- Each section of boxes is labeled with the main energy level + sublevel associated with the orbital
 - Sublevels are s, p, d, f

$$\begin{array}{|c|} \hline \uparrow\downarrow \\ \hline \end{array} \quad \begin{array}{|c|} \hline \uparrow\downarrow \\ \hline \end{array} \quad \begin{array}{|c|c|c|} \hline 1 & 1 & 1 \\ \hline \end{array}$$

1s 2s 2p

Symbol	# e ⁻	Electron Configuration	Noble gas Notation	Orbital Diagram
B	5	1s ² 2s ² 2p ¹	[He]2s ² 2p ¹	$ \begin{array}{ccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow & & & & \\ 1s & 2s & 2p & & & & \end{array} $
Cu	29	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 4s ¹ 3d ¹⁰ (exceptional)	[Ar]4s ¹ 3d ¹⁰	$ \begin{array}{ccccccccccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow & & & \\ 1s & 2s & 2p & 3s & 3p & 4s & 3d & & & & & & & \end{array} $
Mg	12	1s ² 2s ² 2p ⁶ 3s ²	[Ne]3s ²	$ \begin{array}{ccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \\ 1s & 2s & 2p & 3s & & & \end{array} $
As	33	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 4s ² 3d ¹⁰ 4p ³	[Ar]4s ² 3d ¹⁰ 4p ³	$ \begin{array}{ccccccccccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow \\ 1s & 2s & 2p & 3s & 3p & 4s & 3d & 4p & & & & & & \\ & & & & & & & \uparrow & \uparrow & \uparrow & & & & \end{array} $
Zr	40	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 4s ² 3d ¹⁰ 4p ⁶ 5s ² 4d ²	[Kr]5s ² 4d ²	$ \begin{array}{ccccccccccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow \\ 1s & 2s & 2p & 3s & 3p & 4s & 3d & 4p & 5s & 4d & & & & \\ & & & & & & & & & \uparrow & \uparrow & & & \end{array} $
Cl	17	1s ² 2s ² 2p ⁶ 3s ² 3p ⁵	[Ne]3s ² 3p ⁵	$ \begin{array}{ccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow \\ 1s & 2s & 2p & 3s & 3p & & \end{array} $
Cs	55	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 4s ² 3d ¹⁰ 4p ⁶ 5s ² 4d ¹⁰ 5p ⁶ 6s ¹	[Xe]6s ¹	$ \begin{array}{ccccccccccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow \\ 1s & 2s & 2p & 3s & 3p & 4s & 3d & 4p & 5s & 4d & 5p & 6s & & \\ & & & & & & & & & & & \uparrow & \end{array} $
P	15	1s ² 2s ² 2p ⁶ 3s ² 3p ³	[Ne]3s ² 3p ³	$ \begin{array}{ccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow & \uparrow & \uparrow & \uparrow \\ 1s & 2s & 2p & 3s & 3p & & & \end{array} $

Waves Worksheet



Name the labeled wave characteristics

- 1 Trough
- 2 peak or crest
- 3 wavelength
- 4 frequency

Which of the waves has.....

The highest frequency? C

The lowest energy? A

The longest wavelength? A

Speed / Frequency / Wavelength

Speed of all Electromagnetic Spectrum Waves (c) = 3.0×10^8 m/s

$c = \lambda \nu$

1. Violet light has a wavelength of 4.10×10^{-12} m. What is the frequency?

$$c = \lambda \nu$$

$$\lambda = 4.10 \times 10^{-12} \text{ m}$$

$$\frac{c}{\lambda} = \nu$$

$$\frac{3.0 \times 10^8 \frac{\text{m}}{\text{s}}}{4.10 \times 10^{-12} \text{ m}} =$$

$$= \boxed{7.3 \times 10^{19} / \text{s}}$$

2. What is the wavelength (in meters) of the electromagnetic carrier wave transmitted by The Sports Fan radio station at a frequency of 640 kHz? (Hint: convert kHz into Hz by multiplying by 10^3 .)

$$c = \lambda \nu$$

$$\nu = 640 \text{ KHz}$$

$$\frac{c}{\nu} = \lambda$$

$$\frac{3.0 \times 10^8 \frac{\text{m}}{\text{s}}}{640 \text{ KHz}} \cdot \frac{1 \text{ KHz}}{1000 / \text{s}} =$$

$$= \boxed{470 \text{ m}}$$

$$1000 / \text{s} = 1000 \text{ Hz} = 1 \text{ KHz}$$

3. Calculate the wavelength of radiation with a frequency of 8.0×10^{20} Hz. What type of radiation does this represent?

$$c = \lambda \nu$$

$$\nu = 8.0 \times 10^{20} \text{ Hz or /s}$$

$$\frac{c}{\nu} = \lambda \quad \frac{3.0 \times 10^8 \frac{\text{m}}{\text{s}}}{8.0 \times 10^{20}} =$$

$$= \boxed{3.8 \times 10^{-13} \text{ m}}$$

Gamma

4. A helium laser emits light with a wavelength of 633 nm. What is the frequency of the light?

$$c = \lambda \nu$$

$$\lambda = 633 \text{ nm}$$

$$1 \times 10^9 \text{ nm} = 1 \text{ m}$$

$$\frac{c}{\lambda} = \nu \quad \frac{3.0 \times 10^8 \frac{\text{m}}{\text{s}}}{633 \text{ nm}} \cdot \frac{1 \times 10^9 \text{ nm}}{1 \text{ m}} =$$

$$= \boxed{4.7 \times 10^{14} / \text{s}}$$

or Hz

6. An FM radio station broadcasts at a frequency of 107.9 MHz. What is the wavelength of the radio signal?

$$c = \lambda \nu$$

$$\nu = 107.9 \text{ MHz}$$

$$\frac{c}{\nu} = \lambda$$

$$\frac{3.0 \times 10^8 \frac{\text{m}}{\text{s}}}{107.9 \text{ MHz}} \cdot \frac{1 \text{ MHz}}{1 \times 10^6 \text{ Hz}} =$$

$$= \boxed{2.8 \text{ m}}$$

$$1 \text{ MHz} = 1 \times 10^6 \text{ Hz}$$

Energy / Frequency / Wavelength

$$E (J) = h \times \nu$$

$$h (\text{Planck's Constant}) = 6.626 \times 10^{-34} \text{ J} \cdot \text{s}$$

9. Calculate the energy of a photon of radiation with a frequency of $8.5 \times 10^{14} \text{ Hz}$.

$$E = h\nu \quad (6.626 \times 10^{-34} \text{ J}\cdot\text{s}) (8.5 \times 10^{14} \text{ /s}) = \boxed{5.6 \times 10^{-19} \text{ J}}$$

$\nu = 8.5 \times 10^{14} \text{ Hz}$

10. What is the frequency of a wave that has an energy of $1.8 \times 10^{-26} \text{ J}$?

$$E = h\nu \quad \frac{E}{h} = \nu \quad 1.8 \times 10^{-26} \text{ J} \cdot \frac{1}{6.626 \times 10^{-34} \text{ J}\cdot\text{s}} = \boxed{2.7 \times 10^7 \text{ /s}}$$

$E = 1.8 \times 10^{-26} \text{ J}$

11. Calculate the energy of a photon of radiation with a wavelength of $6.4 \times 10^{-7} \text{ m}$.

$c = \lambda \nu$ 1. either solve for ν using $c = \lambda \nu$ then solve for E using the determined frequency.
 $E = h\nu$ 2. or ...

$$\frac{c}{\lambda} = \nu \quad \text{so} \quad E = h \frac{c}{\lambda} \quad (6.626 \times 10^{-34} \text{ J}\cdot\text{s}) \left(\frac{3.0 \times 10^8 \text{ m}}{\text{s}} \right) \left(\frac{1}{6.4 \times 10^{-7} \text{ m}} \right) = \boxed{3.1 \times 10^{-19} \text{ J}}$$

12. What is the energy of light whose wavelength is $4.06 \times 10^{-11} \text{ m}$?

$$E = \frac{hc}{\lambda} \quad (6.626 \times 10^{-34} \text{ J}\cdot\text{s}) \left(\frac{3.0 \times 10^8 \text{ m}}{\text{s}} \right) \left(\frac{1}{4.06 \times 10^{-11} \text{ m}} \right) = \boxed{4.9 \times 10^{-15} \text{ J}}$$

General Knowledge.

13. Rank these parts of the electromagnetic spectrum from lowest energy (1) to highest (7):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
7	3	2	1	4	5	6

14. Rank these parts of the electromagnetic spectrum from lowest frequency (1) to highest (7):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
7	3	2	1	4	5	6

15. Rank these parts of the electromagnetic spectrum from shortest wavelength (1) to longest (7):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
1	5	6	7	4	3	2

16. What is the relationship between frequency and wavelength? (Direct or Inverse)

17. What is the relationship between frequency and energy? (Direct or Inverse)